A Dissertation

on

The Capillary Circulation

By

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The Capillary Circulation

Previous to advancing our opinion on this subject, we will briefly survey the vessels whose function we are to consider. In this we will follow Bichat from whom we derive our ideas on this subject.

The capillaries are vessels located between the arteries and veins, they perform the function of nutrition, and from them proceed the exhalants, and excretories. They are infinitely small and are infinetely divided throughout all organs. Bichat says. "All" (meaning organs) "are in fact composed of an infinity of capillaries which cross, unite, separate, and unite again by communicating in a thousand ways with each other." The same writer observes. "It is in this view that we may with truth consider the

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animal body as an assemblage of vessels."
These vessels do not all convey the same fluid. There are some organs whose capillaries convey red blood only; Others convey both red and white blood; and again others whose vessels convey white blood alone. First, of those organs whose capillaries convey red blood only. These are the muscles, the Spleen, some parts of the Mucous system as the pituitary membrane, &c. We can find nothing but red blood in their capillaries, and they seem made up of red vessels. Secondly, of those whose capillaries convey both red and white blood. These are the Serous membranes, the bones, the cellular texture, part of the fibrous system, the skin, glands, &c. Let us take the peritoneum as an example. In a healthy state its vessels contain but little red blood; to this it owes its transparency, but if it is irritated the sensibility of its vessels is changed and they admit, or take the

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red blood, which was inimical to their sensibility when in a natural state, and the membrane becomes highly coloured. So with the other organs mentioned, in disease, or the skin of the cheeks and neck in emotions of the mind. Again, in conjunctivitis we can distinguish with the naked eye innumerable vessels conveying red blood, which in health were invisible, owing to the absence of that fluid; in some cases a few of these vessels seem to have acquired a sensibility to red blood and ever after convey it. We have considered a few of those organs with one force; Bichat says "The others present the same phenomenon, we shall see that the cellular texture, certain fibrous, &c. &c. examined comparatively on the one hand in animals that we dissect alive, on the other in an inflammatory state or after fine injections, present a much less number of vessels in the first than in the second case." The quantity

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of blood in the different organs of this class varies considerably, thus the serous membranes contain very little, the skin, more, the mucous membranes, a considerable quantity &c.

Thirdly, of those organs whose capillaries, convey white blood only. These are the tendons, the cartilages, hair, &c. In health they contain no red blood and in fact appear inorganized, but their internal growth proves their organ-ization, and it is frequently demonstrated by inflammation and fine injections.

2dly Their anastomosis. There is evidently a free communication between these vessels. In a fine-ly injected serous, or mucous membrane we can perceive innumerable vessels which inosculate with each other at almost imperceptible dis-tances; and in fact these membranes seem composed of a net work, of vessels which traverse them in every direction. Some of

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these vessels invisible in health unite in the same manner with others that are visible in that state there is then a free communication between the vessels conveying red blood, and those which convey white, yet in health the blood of the former does not pass into the latter. 3d. Their structure. Owing to the diminutive size of these vessels, no demonstration can be made of their structure, we however believe it varies materially, in the different organs; because, when it is considered that all parts are almost entirely composed of them, we cannot for a moment suppose their structure to be the same in organs whose functions are entirely different, as the muscles, tendons, &c. Besides, a difference of secretion supposes a difference in sensibility, contractility, and structure; thus the saliva, and pancreatic juice, are secreted by glands

closely resembling each other in structure; but the urine, bile, &c. are secreted by glands differing as widely in structure as those fluids do in their properties.

Having thus considered in a general view, the capillaries, as indispensable organs of the living bodies; we will now go on more particularly to the object of this [illegible].

The Circulation in the Capillaries

This we will divide with Bichat, into the motion of the fluids, and the changes they undergo. The blood after it enters the capillaries, we believe to be without the influence of the heart. it then moves by its contractility. those vessels in the same manner that the chyle moves in the lacteals, the juices of plants. their vessels &c. &c.

Our arguments in support of this doctrine, first taken from Borden, and admirably

subject of the great Book. are

1st The difference in the motion of the fluid which comes to these repeats in the arteries, and those which leave them by the veins exceptions, i.e. First of the veins. So far as our knowledge has ever seen the pulsation of a vein; yet if the blood still retains the impetus given to it by the heart, they should possess this motion; because, the aggregate impulse of the blood from the capillaries would be equal to that from the artery which supplied them. If impulse, or impulse, or it has been given to the heart, the veins to produce a pulse. We are conscious however that those who differ from us, advance the yielding nature of the veins, to account for the absence of pulsation in them: but we think this reason is fallacious. For, if they will take out a vein in a horizontal position and strike gently, and

quickly as it can not remain from the heart, it is a serious motion which sometimes may be perceived to 12 inches at the wrist, convince them that it seems impossible to admit a retrograde motion from the capillaries. There is then nothing to prevent this motion in the veins, therefore as it does not take place we may reasonably infer its non-existence in the capillaries.

Secondly, the Excretories are aspirants. Their action is not in proportion to the action of the heart and arteries. We perceive on the contrary that in violations of the arterial system the secretions and excretions, as those of the skin, kidneys &c., are merely suspended, and it is only when the fever has abated or gone off, that they recommence.

This seems not only to prove the independence of the circulation in these vessels, but also their intimate connexion with the disease. In the first case prove the immoderate use of tobacco, or

[illegible] the same class, the force is so [illegible] reduced, and there is generally an increase of perspiration, urine, &c. [illegible] if the blood must [illegible] the capillaries [illegible] stillness of the heart, [illegible] must be reversed.

II How can the resuscitation of persons supposed to have been dead be accounted for. There can be no doubt of persons having laid in that condition for two or three days and finally recovering their natural powers of life. We all must agree that the circulation continued in these cases and we think [illegible] will agree as to the moving power; for the [illegible] cannot be the heart because we can perceive no motion at it or in the arteries, and it seems impossible to us that a sudden motion could be given to a column of blood in an elastic tube, [illegible] it be ever perceptible. If then the heart is not the moving power, the capillaries are the only organs to which we can look; the powers of

equal to the task, and we be [illegible] cannot be assumed as no probable [illegible] to the independence of the capillary circulation.

Upon this principle it may be accounted for, from the organic irritability and contractility of the capillaries remaining, the blood is conveyed to them from the arteries, into the veins, they not having the weight of the blood to contend with, and being still in habitual life and contractility, are in a contracted state, and cannot contain all the blood in the system (as in death) it therefore passes from them into the heart, thence, influenced by the vehicle by the capillaries, into the arteries, and again passes the round of the circulation. In the lungs it is changed as usual, by the small quantity of air, which, in these cases circulates through them, and is confined to the lungs as the blood moves slowly. In favourable cases this process continues to increase the sensorial power, or Darwin's termed,

until the heart is gradually brought into play, and animal life is fully restored.

On this principle we might explain the continuance of perspiration after death. Again, in the same manner the presence of blood in the veins might be accounted for: this is strengthened by the fact that in death we sighing, bringing the blood back in the arteries. The application of the principle is easy.

III How can the recession of blood, in the cold stage of intermittent fever be accounted for. It cannot be owing to any change in the temperature, because, admitting there was such, it would be nearly as apt to affect one hour as another. Either it does not arise from a diminished action of the heart for we have in cases where it was much more vigorous without any stage of cold taking place; besides why are the internal organs in a state of congestion? why does not the heart

know the blood to the surface with as much force as is the organs? If it is so a priori therefore we will reject the hypothesis. We will now attempt an exploration of the principle which we are endeavouring to establish. Thus, the organic irritability of the capillaries, at the skin, is altered by the sympathy existing between them, and the original seat of the disease: now the blood is, to this altered irritability a foreign substance, and is repelled altogether: this accounts for the constriction and coldness of the surface. It is evident then that a much less quantity of blood than natural, can be disposed of in the capillaries of the surface, consequently a greater quantity flows in to the internal organs producing congestion of them. Thus we have a blood letting which lessens the quantity in the general system, or by an emetic which lessens the quantity in the organ by equalizing the circulation. The effect

IV

[illegible] [illegible] [illegible] [

Thus, if an irritant is applied to a part, a change is produced in the sensibility of the capillaries, and they are enabled to act in a manner to the red blood which is now freely received, and as freely flows to them. This we will endeavour to explain. We all know that the arteries are constantly more or less distended with blood. It then follows as a natural consequence that when an artery is wounded a greater quantity of blood will press into it than when it is sound. Now the capillaries arise from the arteries, and take from them the fluids ordained for their several functions. It is then evident to all that, if the sensibility of these vessels is altered, and they take from the arteries a greater than natural quantity of blood, the effect will be the same as that produced by the wound i.e. there will be an increased efflux into the arteries. We have thus explained the efflux, which produces the second phenomenon of inflammation,

to wit, redness. The sensations which are in gradation from a simple itching to the most violent pain, are owing to the organic sensibility of the capillaries becoming aroused, whereby impressions which were previously confined to the vessels themselves are now transmitted to the brain. It would be too far from my object to consider the cause of the swelling, we will therefore pass on to the modification of inflammation in the different tissues.

Supposing an impossibility; that local inflammation could take place if the heart were the sole moving power of the circulation, how could the advocates of this opinion account for the modification of it in the different tissues: they cannot imagine in what manner this could offer an explanation of a fact, which none can doubt, therefore we will endeavour to make up their deficiency. It has been known that there are organs whose capillaries differ from the capillaries of other organs

in structure. These sensibilities [illegible]

[illegible] causes of [illegible]

[illegible] wounds.

as to their structure, sensibility, and consequently

are different it is evident these diseases will be

different. The causes of inflammation will also act

differently, for some are affected by the direct application

of the cause, others seem only to be affected by sympathy,

except in cases of wounds. The peritoneum is an ex-

ample of this. There is also some difference in the causes,

for instance air in contact with the lung conjunctiva,

or with the mucous membranes produces no effect but

it generally produces inflammation of the peritoneum

if brought into contact with it. Now it is evident

from what has been said, that inflammation is different

in the different tissues, it is still inflammation, but

it is modified by the part in which it exists. In mu-

cous membrane it is acute and moves rapidly through

its different stages, but in the tendons, bones, &c it is

much more chronic. The inflammation in these organs seems to be in proportion to the activity of their circulation. We see by the tardiness with which union is effected in a fracture of a bone, a like tardiness in its circulation. While on the other hand in the rapidity with which lost substance is replaced in a mucous membrane, we see an image of its lively circulation.

V If the heart was the sole moving agent of the circulation, the blood would pass indiscriminately into all the vessels. This would take place notwithstanding the arrangements of Boerhaave for the circulation. But as the capillaries are not inanimate tubes but have a consciousness, will, and contractility of their own, nothing is permitted to enter them but fluids which are in relation to their sensibility.

Were it not for this faculty, there would be no separation of the fluids, all vessels would convey red blood, and all parts would be red

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As to the changes which take place, we only know that in the lungs the venous, or black blood is changed into arterial or red blood; and that in the general capillary system it is vice versa. In what manner this is effected, whether by the addition or subtraction of some principle, we believe has not been satisfactorily determined.

We have now brought to a conclusion our essay on the Capillary Circulation. Two things we hope have been proven, 1st The Independence of the Capillary Circulation and 2dly That the arteries should be considered as resembling, more a set of reservoirs than pipes for forcing pumps